GOVERNMENT OF INDIA
MINISTRY OF COMMERCE AND INDUSTRY

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REPORT

OF THE

INDIAN TARIFF BOARD

ON THE

FAIR RETENTION PRICES, EX-WORKS, OF PIG IRON INDUSTRY

BOMBAY
1951

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GOVERNMENT OF INDIA
MINISTRY OF COMMERCE & INDUSTRY
RESOLUTION
(Tariffs)

New Delhi, the 30th July, 1951.

No. SC(A)-2(72)/51.- In their Resolution No. 10-T(3)/49, dated the 13th October, 1949 in the late Ministry of Commerce, the Government of India fixed the current ex-works retention prices for different grades of pig iron, based on the Tariff Board's report, for one year with effect from the 1st November, 1949. At the time of its last inquiry, the Board had been given to understand that the new coke oven battery at the Hirapur Works of the Indian Iron and Steel Company, scheduled to go into production in the course of the year 1949, would bring about a definite improvement in the quality of coke and consequent reduction in its consumption, thereby lowering the cost of production of pig iron. The Board, therefore, recommended that the fair retention prices for pig iron should be reviewed at the end of a year. Government accepted this recommendation and decided that the costs should be re-examined after a year. In accordance with this decision, the Board was asked to undertake the necessary review. The Board, having conducted its inquiry, has submitted its Report. Its main conclusions and recommendations are as follows:-

(1) Of the three manufacturers of pig iron in the country, *viz.*, the Tata Iron and Steel Company, the Indian Iron and Steel Company, and the Mysore Iron and Steel Works, neither the Tata Iron and Steel Company nor the Mysore Iron and Steel Works regularly produces foundry grades of iron for sale to merchant foundries. In future, practically all the pig iron manufactured at the Hirapur Works of the Indian Iron and Steel Company (IISCO) will be used for steel-making by Steel Corporation of Bengal.

Accordingly, the Kulti plant of IISCO should be regarded as the sole regular producer of irons of foundry grade, and the price for iron of such grades must be based solely on the costs of production at the Kulti Works.

(2) The Board has made a detailed analysis and examination of the works cost of the Kulti plant and has estimated the future works cost of grade III foundry iron at Rs. 83.29 per ton, on the basis of an estimated annual production of 200,000 tons.

(3) In determining the overhead charges, the same principles as had been adopted in the previous report have more or less been followed, except in respect of depreciation. Having regard to the necessity of replacing the present Kulti plant after five or six years, a total provision of Rs. 24 lakhs for depreciation (Rs. 11 lakhs as normal depreciation and Rs. 13 lakhs (gross) as special depreciation) has been recommended.

(4) The Railway Board should be requested to review the question of restoring the original concessional freight rate on the movement of iron ore from Gua to the Kulti Works with a view to assisting the Company to reduce the cost of pig iron.

(5) The minimum pig iron consuming capacity of Indian foundries is estimated at 400,000 to 420,000 tons a year, while the present screened demand is of the order of 600,000 tons a year.

(6) At present only about two-thirds of the minimum and less than half of the annual screened demand of the foundries can be met from available indigenous supplies of pig iron. As the Steel Corporation of Bengal and the Tata Iron and Steel Company proceed to implement their expansion programmes for steel within the next two or three years, the position of supply of pig iron to the foundries will become acute which will have a serious effect not only on industry in general, which requires castings as components of machinery and equipment and as spare parts for maintenance, but also on agriculture as a result of the shortage of agricultural implements and on the Railways as a result of inability to provide replacement parts. Government should, therefore, give their most serious consideration to

this problem and take such action as would ensure availability of adequate supply of iron to the general foundry trade, having due regard at the same time to the need of maximising the steel production of the country.

(7) In view of the critical shortage of iron, it is essential that measures should be taken to make available to the foundries those qualities of iron which they require most and can use best. For this purpose, it is necessary that the foundry iron production at Kulti should consist chiefly of the high silicon grades, *viz.*, 2.25 per cent. to 2.75 per cent. and 2.75 per cent. to 3.25 per cent.

(8) The current price schedule of pig iron does not provide adequate compensation for the extra cost of producing the types of foundry iron which are required by the Indian foundries with the result that such types are not being produced at present in sufficient proportions. A new formula for differentials has, therefore, been recommended. The Board's formula, while providing proper compensation to the producers for their extra costs in producing the desired grades of iron, would at the same time help the foundries to avoid cost increases resulting from the extensive use of high-cost ferro-alloys. It would also give incentive to the integrated steel works to provide iron of more suitable analysis to the foundries.

(9) Based on the new formula for differentials, the following schedule of *ex*-works, retention prices for pig iron has been recommended:-

STANDARD GRADES

(High Manganese)

Grade		*Silicon* per cent.	*Manganese* per cent.	*Phosphorus* per cent.	*Sulphur* per cent.	Proposed ex-work price per ton.
						Rs.
Standard foundry.	1	2.75-3.25	1.00-1.50	Under 0.40	Under 0.035	118
	2	2.25-2.75	"	"	Under 0.050	114
	3	1.75-2.25	"	"	"	110
	4	1.50-1.75	"	"	"	108
Special	4X	1.25-1.50	"	Under 0.35	"	106
Special basic.		1.00-1.25	"	"	"	104
Standard basic.		1.00 & under	"	"	"	102

LOW MANGANESE GRADES

Grade		*Silicon* per cent.	*Manganese* per cent.	*Phosphorus* per cent.	*Sulphur* per cent.	Proposed ex-work price per ton.
Low manganese foundry.	1	2.75-3.25	0.50-1.00	Under 0.40	Under 0.035	116
	2	2.25-2.75	"	"	Under 0.050	112
	3	1.75-2.25	"	"	"	108
	4	1.50-1.75	"	"	"	106
Special	4X	1.25-1.50	"	Under 0.35	"	104
Low manganese basic special.		1.00-1.25	"	"	"	102
Low manganese basic.		1.00 & under	"	"	"	100

In addition, the following schedule of quality differentials for all grades has been recommended:-

Silicon: Rs. 4/- per ton extra for each increase of 0.50 per cent. above No. 1 foundry grade.

Manganese: Rs. 2/- per ton penalty for manganese below 0.50 per cent. and Rs. 2/- per ton premium for each 0.50 per cent. increase above 1.50 per cent.

Sulphur: Penalties for off-grade:- Rs. 2/- per ton for sulphur up to 0.065 per cent. and under, Rs. 5/- per ton for sulphur between 0.066 per cent. and 0.080 per cent., and Rs. 10/- per ton for sulphur over 0.080 per cent.

2. The Government of India have accepted all the recommendations of the Board and have decided to fix the ex-works retention prices, as above, from the 1st August, 1951 for a period of three years. The price increases now granted are subject to the condition that the special depreciation allowed to the Company, namely, Rs. 13 lakhs (gross), is actually set aside for depreciation and used by the Company for replacement of the present Kulti plant and that no part of it is utilised in or towards the payment of any dividends or in the distribution of profit-sharing bonus to employees or for distribution of profits.

3. As regards recommendation (6) referred to in paragraph 1 above, the Government of India are aware of the position and fully alive to the need for supplementing the existing sources of supply. With this end in view, Government have been taking steps to interest private parties to put up one or more new plants to produce 3,75,000 to 5,00,000 tons of pig iron.

4. The Government of India hope that the Indian Iron & Steel Company will take steps to implement recommendation (7) referred to in paragraph 1 above.

5. The selling prices will continue to be on export basis and will be Rs. 15/- per ton over and above the *ex*-works retention prices.

S.A. VENKATARAMAN
Secretary to the Govt. of India.

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REPORT ON THE FAIR RETENTION PRICES, EX-WORKS, OF PIG IRON

Terms of reference.

The current prices for different grades of pig iron, based on the recommendations of the Board in a previous Report, were fixed by the Government of India in the late Ministry of Commerce in their Resolution No. 10-T(3)/49, dated 13th October, 1949, with effect from 1st November, 1949. The Board had been given to understand that the new coke oven battery at the Hirapur Works of the Indian Iron and Steel Company (IISCO), scheduled to go into production in the course of the year 1949, would bring about a definite improvement in the quality of coke and a consequent reduction in its consumption, thereby lowering the cost of production of pig iron. The Board, therefore, recommended that the fair retention prices for pig iron should be reviewed at the end of a year. Government accepted this recommendation and decided that the costs should be re-examined after a year, *i.e.*, after 31st October, 1950. As, however, the inquiry into steel prices was scheduled to commence early in January 1951, the Board decided that the inquiry into pig iron prices should also be taken up at the same time.

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Method of inquiry.

2. The Board in its letter dated 7th December, 1950, informed the Indian Iron and Steel Company that the Board proposed to examine its works cost as soon as intimation was received that the Company's books were ready for examination. When the Board's Cost Accounts Officer visited the works of the Steel Corporation of Bengal in January, 1951, he took the opportunity to examine the works cost at Kulti also. The period he selected for examination was November 1949 to October 1950. Mr. Peter V. Martin, the Board's Technical Adviser, also visited the works at Kulti during his stay at Burnpur. As the Indian

Iron and Steel Company and the Steel Corporation of Bengal had presented a joint memorandum in respect of both pig iron and steel prices, the representatives of the two companies were jointly examined on 13th, 14th, 16th and 17th April 1951. Shri C.R. Natesan, Deputy Secretary to the Government of India in the Ministry of Commerce and Industry and Shri M.K. Powvala, Iron and Steel Controller, Government of India, were also examined on 18th April.

Foundry Iron production.

3. Pig iron in India is produced by three companies, *viz.*, the Mysore Iron and Steel Works, the Tata Iron & Steel Co. and the Indian Iron & Steel Co. Of these, however, neither the Mysore Iron & Steel Works nor the Tata Iron & Steel Co. regularly produces foundry grades of iron for sale to merchant foundries. The plant of the Mysore Iron & Steel Works at Bhadravati is equipped with only one small blast furnace with a capacity of 80 tons per day, the entire output of which is consumed in the Work's own foundries and steel works. The expansion plans of this Works presently contemplate the addition of two electric blast furnaces with a combined capacity of about 100,000 tons per year, but an equivalent expansion is contemplated in the steel works and the additional pig iron production is expected to be wholly consumed within the Works. The Mysore Iron & Steel Works cannot accordingly be considered as a possible supplier of iron to the merchant foundries.

4. The Tata Works was built in 1911 as an integrated unit for the production of semi-finished and finished steel. Its capacity for the production of pig iron accordingly was originally based on the pig iron consumption of its own steel-making departments and this policy has been followed throughout all stages of the Company's expansion. From time to time, particularly during the depression years of the thirties, when the full facilities for producing steel were not in use, the Company found it possible occasionally to produce relatively small tonnages of foundry iron for sale. Since the war, however, the Tata Company has consumed all of

the iron which it has produced with the exception of incidental small tonnages, chiefly off-grade in specification most of which was not of desirable quality for use either for steel-making or foundry purposes.

In the inquiry into steel prices during the current year, the steel production rate of the Tata Company was established as 780,000 tons of saleable steel which is considered as the current plant capacity. The production of this quantity of steel will require the use of its total output of pig iron with the exception of perhaps 60,000 tons which was established as the quantity of iron which the Company might have for sale. The general plant conditions at the Company's Works, like those at most integrated steel works, are such that a capacity rate of steel production requires that the blast furnaces be operated in such a fashion that the entire production of pig iron be of a quality suitable for steel-making. As most grades of foundry iron are not of desirable quality for steel-making, particularly by the processes employed in India, any attempt to produce at the Tata Works a slight excess of iron amounting to, say 5 per cent. of its total production, to foundry grade specifications, might jeopardize the attainment of its steel production goal and would certainly tend to increase the cost of steel production. Thus the Tata Company, like the Mysore Iron & Steel Works, cannot at the present time be considered as a normal source of iron of foundry grade.

Currently, the Tata Company's pig iron production tends to be limited somewhat by inadequate coke production as one of the batteries of coke ovens is being re-built and enlarged. During the next two years, the production of the pig iron tonnages forecast in the Board's report on steel prices will be possible only because the Company has been able to arrange for the supply of 50,000/100,000 tons of coke from IISCO and because of the very low rate of coke consumption which has been achieved during the past year. It may be possible to increase the production of pig iron slightly following the putting into operation of the new coke oven battery in 1953 but the operation of the present blast furnace plant at the rate made possible by the resulting increase in coke production will not supply sufficient iron for the Company's expansion programme for steel which may be under way by that time and which will require enlarging some of the smaller furnaces. There is accordingly little liklihood that the Tata Company will ever become a producer of other than minor quantities of incidental iron for sale.

5. The remaining pig iron producer, *viz.*, the Indian Iron and Steel Co. has been the historic supplier of foundry irons, not only to the general trade but also to its own foundries which are the largest in India. The plant of this Company at Kulti which was purchased from the Bengal Iron Co. in 1936 and had been originally built in 1874, was the first blast furnace plant of modern type to be built in India.

The Company owns two blast furnace plants, both in West Bengal. The Hirapur plant is composed of two blast furnaces and three batteries of coke ovens and is located at Burnpur. The Kulti plant is likewise composed of two blast furnaces of much smaller capacity and four batteries of coke ovens. At Kulti also are located several foundries of the Company.

Prior to 1940, the Indian Iron and Steel Company produced no iron for direct conversion into steel but all of its product was put through the pig machine and shipped as cold pig. Its operations accordingly did not have to be correlated with steel production and the furnaces were operated so as to produce whatever types of iron were in demand by indigenous foundries and in the export market.

6. In 1940, however, the plant of the Steel Corporation of Bengal (SCOB) was built immediately adjacent to the Hirapur Works to produce steel from hot metal supplied from the Hirapur blast furnaces. While the two plants were owned by separate companies, the two companies were under the

control of the same Managing Agents and the dependence of SCOB on IISCO was such that successful operation of SCOB required that the two plants should be operated as an integrated works.

The results of the past relationships between these two works have been described in considerable detail in the Board's Report on Steel Prices (1951) and need not be repeated here. In brief, it may be stated that the Board has concluded that the manner of operating the Hirapur blast furnaces to produce both foundry and steel-making iron was a major factor in preventing capacity production at SCOB and that in future the Hirapur plant must be operated solely as an auxiliary of SCOB. As such the Hirapur plant will not normally produce any iron of foundry grade and the blast furnaces will produce only steel-making iron. Under such conditions of integration, SCOB is expected to consume all of Hirapur's production and, as at the Tata Works, any iron for sale will be only incidental to steel-making. Unlike the Tata Works, however, the iron-consuming capacity of SCOB is greater than the iron-producing capacity of Hirapur and it is extremely unlikely that there will be any surplus iron for sale from Hirapur in the future.

7. Historically, the Hirapur plant has been the major supplier of iron to the Indian foundry trade. During the war years, full operation of both the Hirapur and Kulti plants was not possible and, as the Hirapur furnaces are more modern and efficient, operations at Kulti rather than at Hirapur were curtailed. After the war, labour difficulties and, subsequently, shortage of coke made operation of all four furnaces impossible until the new battery of coke ovens was brought into operation in 1950. Only since early 1950 have all the four furnaces of the Company been in continuous operation with the exception of required shutdowns for relining. As practically the entire production of Hirapur will be utilized at SCOB, the Kulti plant has now become the sole regular producer of irons of foundry grade. The prices for iron of such grades accordingly must be based solely on the costs of production at the Kulti works.

Basis of determination of current retention prices.

8. This represents an important departure from the method followed in the previous inquiry in 1948 upon which the current prices of foundry iron are based. At that time, the supply of coke was adequate to permit the operation of only three of the four furnaces of IISCO and, in practice, while at Hirapur both the furnaces were operated, at Kulti only one of the two furnaces was in production. The production of 440,000 tons of iron was estimated at Hirapur and 126,000 tons at Kulti. Of the total production at Hirapur, 264,000 tons were to be supplied to SCOB in the form of hot metal (steel-making grades) and the balance of 176,000 tons were to be of foundry grade for sale. Of the Kulti production, 15,000 tons of high silicon and 72,000 tons of other foundry grades were expected to be consumed by the foundries of IISCO which left only 39,000 tons of foundry iron available for sale from Kulti. Out of a total production of 566,000 tons of iron by IISCO, accordingly 215,000 tons were expected to be available for sale of which 176,000 tons were to be produced at Hirapur.

The works cost of producing the total tonnage of standard foundry grades which amounted to a total of 287,000 tons (215,000 tons for sale and 72,000 tons for own use) was, accordingly, calculated on the basis of the weighted average cost of producing 176,000 tons at Hirapur and 111,000 tons at Kulti, and the overheads were established on a composite block consisting of that fraction of the total block at Hirapur which was represented by the ratio of foundry iron to total iron production plus the estimated value of the Kulti block.

Basis of determination of future retention prices.

9. In the determination of future prices of foundry iron, however, as no such grades will be regularly produced at Hirapur, the Hirapur Works, like the Tata Works, must be disregarded. Accordingly, Kulti costs alone must be considered in establishing foundry iron prices.

In the previous inquiry, the Board had determined the average works cost of producing the different grades of foundry iron at Rs. 70.99 per ton for Hirapur and at Rs. 72.35 per ton for Kulti, which represented a difference of only Rs. 1.36 per ton between the two works. The actual difference in works costs between the two works under normal conditions should be considerably greater, being probably of the order of magnitude of Rs. 10-15 per ton due to the fact that at Kulti the coke plant is obsolete and a high-cost unit, the blast furnaces are much smaller and less modern and, consequently, not as efficient, and by-product credits are much less. The high estimate of works cost at Hirapur at the time of the previous inquiry was due in a large measure to the shortage of coke at Hirapur which necessitated purchases of outside coke at much higher prices than the works costs of coke at Hirapur. This condition has since been remedied by the construction of a new coke oven battery at that works. It is also quite likely that the reported works costs of foundry grade irons at Hirapur are somewhat inaccurate as no separate cost records are kept for the steel-making and foundry irons but the costs of each are calculated by the use of arbitrary formulae.

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Kulti works costs for 1949-1950.

10. The Cost Accounts Officer and the Technical Adviser examined the records of works costs at Kulti for the period from November 1949 to October 1950 and determined that the weighted average works cost of all grades of iron was Rs. 85.05 per ton. The Cost Accounts Officer's Report containing a detailed cost analysis, has been already forwarded to Government as a separate confidential enclosure to the Report on Steel Prices. The figure of Rs. 85.05 per ton, however, is not exactly comparable to the works cost estimated in the previous inquiry as two minor departures were made in determining the actual 1949-50 costs. In estimating the 1948 costs, the head office expenses had been considered as an item of works costs. In determining the actual costs for 1949-50, the head office expenses were excluded from works costs and considered as overheads, in

accordance with normal accountancy practice. There was also a change in the allocation of transportation charges between pig iron and castings produced at the Kulti foundries. At the time of the 1948 inquiry, the allocation was made on the basis of relative labour costs which resulted in pig iron bearing only 20-21 per cent. of the total transportation charges of the combined blast furnaces and foundries. For the purpose of the 1949-50 costs, it was considered more proper to base this distribution on estimated relative tonnages of materials handled, which has resulted in pig iron bearing 75 per cent. of the transport costs. The actual head office expenses chargeable to pig iron amounted to Rs. 1.5 per ton and the altered method of distributing transportation charges added Rs. 2.36 per ton to the works costs of iron. The adjusted works cost per ton for 1949-50, after compensation for these alterations in the costing method, is Rs. 84.19 which is the figure which should be compared with the Board's estimate of Rs. 72.35 per ton in 1948.

11.(a) The increase in works costs for 1949-50 above the Board's previous estimate accordingly is Rs. 11.84 per ton, which is equivalent to an increase of 16.4 per cent. The distribution of the cost increase between materials and conversion costs is as follows:-

Analysis of cost increase.

	Board's 1948 estimates	Nov. 1949 to Oct. 1950	Increase	Percentage increase
	Rs. per ton	Rs. per ton	Rs. per ton	
Net material cost	53.16	61.42	8.26	15.5
Conversion cost	19.19	22.77	3.58	18.7
Total cost	72.35	84.19	11.84	16.4

The increase in material costs resulted chiefly from (1) increase in consumption of iron ore, and (2) increased costs of raw materials.

Item No.(1), *viz.*, increased consumption of ore, is a phenomenon common to all the three blast furnace plants investigated during the pig iron and steel inquiries. There is positive evidence that the quality of iron ore has deteriorated somewhat, particularly physically, during the past three years and the Tata Company as well as IISCO is now consuming greater quantities of ore per ton of product. There is no immediate remedy for this situation as it can only be corrected by a long range programme of ore beneficiation which both companies have under consideration but which cannot be implemented at the present time owing to lack of funds. The actual increase in ore consumption at Kulti amounted to 256 lbs. per ton of iron, which is equivalent to an increase of about 7 per cent. over the Board's previous estimate. At 1948 prices, the increased consumption of ore would raise iron costs by approximately Rs. 0.9 per ton. At 1949-50 prices, the increase in costs due to this factor was about Rs. 1.4 per ton of iron.

The major portion of the increase in material costs, however, resulted from item No.(2), *viz.*, increases in costs of raw materials. The major change in raw material costs was in iron ore the cost per ton of which was taken in the 1948 estimate at Rs. 8.689 but which actually rose to Rs. 11.781 in 1949-50, an increase of Rs. 3.092 per ton of ore. The Board's 1948 estimates provided for 1.6 tons of ore per ton of iron. The price increase accordingly accounted for an increase in works cost of Rs. 4.92 per ton of iron. The total increase in costs due to both increased prices and greater consumption of ore was about Rs. 6.

The higher costs of ore were due in part to higher mining costs, increases in the price of ore purchased from Bird & Co., and increases in freight rates. A major portion of the increase, however, resulted from the withdrawal of the concessional freight rate on the movement of Gua ore to Kulti. The rate currently charged for Gua ore from the mines to Kulti is Rs. 8.500 per ton while the rate to Hirapur is only Rs. 4.258 per ton despite the fact that the plants are only 8 miles apart. In the interest of economy in future, we have recommended the use of Gua ore at only Hirapur. At times, however, this may be a handicap to both plants and we accordingly recommend that the Railway Board should review the question of restoring the original concessional freight rate to the Kulti works with a view to assisting the Company to reduce the cost of pig iron.

The remainder of the increased material cost of approximately Rs. 2.0 can be attributed to an increase in the price of limestone of Rs. 1.28 per ton and that of manganese ore of about Rs. 7.39 per ton plus a small increase in the consumption of coke.

(b) As regards the conversion costs, there were relatively minor increases in the cost of stores, utilities and turbo blower. These were due in large part to higher prices paid for operating supplies and repair materials. Practically the whole of the increase in conversion costs, however, was occasioned by the increase in repair and maintenance expense which amounted to Rs. 5.23 per ton in comparison with the Board's previous estimate of Rs. 1.99 per ton, representing an increase of Rs. 3.24 per ton or 90 per cent. of the total increase of Rs. 3.58 in conversion cost. A minor portion of this increase was caused by increases in the prices of repair materials. There is, however, no clear-cut line of demarcation at Kulti between charges for repairs and maintenance and those for relining. The relining provision at this works has been entirely inadequate and it is probable that certain portions of relining costs have been charged to repairs and maintenance. The total charges for relining and repairs and maintenance come to Rs. 5.98 per ton. While we consider these charges somewhat excessive, in view of the age of the plant and the small size of the blast furnace units, it is expected that such charges should be much greater than at either Hirapur or at the Tata Works. Better maintenance practice, however, should result in reducing such costs and while in the estimates for the future we have substantially increased the provision for relining, we have also simultaneously reduced the repair and maintenance allowance so that the total of the two will be somewhat lower than the 1949-50 costs.

On the whole, however, with reference to the 1949-50 works costs at Kulti, we are of the opinion that the increased costs were substantially beyond the control of the management and that the plant in its present condition will continue to be a high-cost unit.

Estimates of future works costs.

12. Representatives of the Company, the Cost Accounts Officer and the Technical Adviser met in several conferences to discuss the future works costs at Kulti. There was general agreement on most cost factors, as indicated below:-

(a) The total production of all grades of foundry and high silicon irons should be taken at 200,000 tons annually. In the past, the Kulti furnaces have been rated at a somewhat higher capacity but in the course of the past ten years the plant has never been able to operate both furnaces simultaneously for a full calendar year until 1950. During the sample 12 months period, November 1949 to October 1950, during which time both furnaces were in operation except for a shut-down of one furnace for repairs for 37 days, the plant produced 201,766 tons. Proper allowance must, however, be made for the age and condition of the plant which will require an abnormal amount of idle time for repairs and, in addition, one furnace is scheduled to be shut down for relining in 1952 and one in 1953.

A further factor which will tend to curtail total tonnage is that, in view of the serious situation with respect to supplies of foundry iron in India, which will be discussed later, this plant should endeavour to produce irons of a higher average silicon content than has been the case heretofore.

In the light of the above factors, a production rate of 200,000 tons per year is considered reasonable for the Kulti works.

(b) *Coke Plant:* It had originally been the Company's intention to shut down two of the four batteries of coke ovens at Kulti and to supply an equivalent amount of coke from Hirapur. In view, however, of the demand for coke for Sindri and from the Tata Company, it was considered advisable to continue operation of all the four batteries for the present.

Since coke produced at Hirapur is of a better quality, as much coke will be brought from Hirapur to Kulti for furnace use as possible. An equivalent quantity of Kulti coke will be sold. The surplus of Hirapur nut coke will also be consumed at the Kulti furnace.

All coke to be brought in from Hirapur will be charged to Kulti at control price plus transport charges.

The yield of coke from the Kulti ovens will be reduced from 76 per cent. to 73 per cent. which will increase the cost of coal charge slightly over Re. 1 per ton.

(c) *Blast Furnace:* The consumption of coke per ton of iron will be taken at 2,650 lbs.

Turbo blower costs will be taken at Rs. 4.4 per ton of pig iron.

Relining reserve will be increased to Rs. 2.0 per ton and repair and maintenance costs reduced to Rs. 3.50. The Company, while in general agreement with this provision, considered it somewhat low at the present time in view of the depleted condition of the relining reserve.

(d) Prices of raw materials and stores and rates of wages adopted in the estimates of works costs for the future were established by the Cost Accounts Officer in consultation with the Technical Adviser and with the approval of the Board. The basis of establishing prices in the major categories of purchase was as follows:-

(1) *Raw Materials:-*

(i) *Coal.-* The controlled rates of coal were adopted in determining the coke cost.

(ii) *Manganese ore, Limestone and Phosphate Rock.-* In estimating the cost of the above materials for the future, the estimated raising cost of manganese ore and the latest purchase rates of limestone and phosphate rock were taken.

(2) *Labour:-* In the labour cost for the future, provision for annual grade increments has been made.

(3) *Stores:-* An increase of 20 per cent. for increase in stores prices has been allowed in the estimates.

(4) *General Works Expenses:-* No increase has been allowed over the costs of the sample period from November, 1949 to October, 1950 as the expenditure under this item is already high and we expect the Company to effect economy.

13. On the above basis, we have calculated the future works costs at Kulti. The weighted average cost, based on the actual production of different grades of pig iron, comes to Rs. 83.29 per ton. This represents a decrease of Rs. 1.76 per ton, which is equivalent to a decrease of slightly over 2 per cent. from the actual costs for 1949-50, despite the fact that higher wage increments have been allowed and provision made for a substantial increase in the price of store materials.

The differentials in works costs of producing the various individual grades of iron will be established in a later paragraph.

Overheads.

14.(a) *Value of the Block.*- Having determined the works cost, we shall now discuss the overheads to be allowed to arrive at the fair ex-works prices. The first point we have to decide in this connection is the original value of the block. In our Report on Hot Metal and Pig Iron (1949), it was pointed out that at the works at Kulti, which had previously belonged to the Bengal Iron Company and was taken over by the Indian Iron and Steel Company in 1936, at a negotiated price, the book value of the plant as at 31st March, 1948, was Rs. 248 lakhs. This, however, included blocks relating to the pipe foundry, brass foundry, spun pipe foundry and collieries. In the course of the previous inquiry, the Board discussed at length with the representatives of the Indian Iron and Steel Company how the original value of the block at Kulti should be determined. The Company suggested various alternative methods. The Board, after carefully examining these suggestions, came to the conclusion that the best course would be to assess the value of the Kulti block at the same rate as the Hirapur block per ton of production. In the case of the Hirapur block, this rate worked out to Rs. 109.5 per ton of production. The Board in its previous Report (1949), estimated the production of pig iron at Kulti at 126,000 tons. On the basis of a rate of Rs. 109.5 per ton of production, the Board estimated the original value of the Kulti block at Rs. 138 lakhs. At that time, however, one of the furnaces at Kulti was out of commission. At the present time, both the furnaces at Kulti are in operation and we have estimated the production at 200,000 tons of pig iron. Assessing the value of the Kulti block, as in 1948/49, at Rs. 109.5 per ton of production, the original value of the block at Kulti comes to Rs. 219 lakhs. This is only for the block relating to the production of pig iron; in other words, this amount excludes the block relating to the foundries and collieries. Our Technical Adviser has carefully examined the estimate of the block and has agreed that, considering the age of the plant as well as its present replacement value, this estimate is reasonable.

(b) *Depreciation.*- In our previous Report on the Retention Prices of Pig Iron (1949), we allowed Rs. 30 lakhs for depreciation on a combined block of Rs. 720 lakhs. Excluding Rs. 100 lakhs from the Hirapur block for the plant and machinery employed for the services to the Steel Corporation of Bengal, the rate of depreciation works out to about 5 per cent. Based on the above percentage, the normal depreciation on the Kulti block as at present estimated should be about Rs. 11 lakhs. Our Technical Adviser is of the opinion that the two blast furnaces at Kulti can be economically operated only for five or six years more, after which they have to be replaced. We are informed that the replacement cost of the blast capacity at Kulti (600 tons per day) at current prices for plant and machinery, will be about Rs. 3.6 crores. It is possible that the replacement cost may come down to some extent during the next five or six years, but it will still be appreciably above the present book value. Having regard to these considerations and in consultation with our Technical Adviser, we have come to the conclusion that it would be fair to allow an additional gross amount of Rs. 13 lakhs for replacement (that is, inclusive of income-tax on the amount of depreciation which is in excess of what the income-tax rules would permit). The total provision for depreciation thus comes to Rs. 24 lakhs (that is, Rs. 11 lakhs as normal depreciation, *plus* Rs. 13 lakhs (gross) as special depreciation).

(c) *Head Office expenses.*- In our previous Report (1949) the Head Office expenses were included in the works costs. This time we have not allowed it in works costs and we propose to provide Rs. 3 lakhs on account of Head Office expenses.

(d) *Interest on working capital.*- In our previous Report (1949), we had allowed Rs. 200 lakhs for working capital for a production of 566,000 tons of pig iron. If we proceed on the same basis, the working capital required for the production of 200,000 tons of pig iron would be Rs.71 lakhs. There has, however, been an increase in works costs by about 15 per cent. Allowing an increase of 15 per cent. on this account, the working capital required for a production of 200,000 tons of pig iron comes to Rs. 82 lakhs. Interest at 4 per cent. per annum on this amount works out to Rs. 3.28 lakhs.

(e) *Return on block.-* As in the case of steel, we have allowed a return of 8 per cent. on the gross block. This return is intended to cover managing agency commission, profit-sharing bonus, and dividends to shareholders.

(f) *Contingencies.-* In our previous Report (1949), we had allowed contingencies at the rate of Rs. 2 per ton of output. We have allowed the same rate on the present occasion also.

(g) The following table summarises the various items we have allowed under overheads:-

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	Lakhs of rupees
Return on block capital of Rs.219 lakhs at 8% .	17.52
Depreciation.	24.00
Head Office expenses	3.00
Interest on working capital of Rs. 82 lakhs at 4 per cent.	3.28
Contingencies	4.00
	51.80

The overhead charges as estimated above, when distributed over a production of 200,000 tons of pig iron, would work out to Rs. 25.90 per ton as against Rs. 19 per ton, which had been allowed in the previous inquiry.

Allocation of works costs and overheads to various grades of iron.

15. Having determined the average works costs of foundry iron, which may be taken as Grade No. 3, at Rs. 83.29 per ton, and the average overheads, corresponding to the same grade, at Rs. 25.90 per ton, we must now determine the proper differentials in works costs and overheads between the various individual grades, in order to arrive at the proper retention price for each grade. For this purpose, it is necessary (1) to survey the general foundry iron situation in India in order to determine the demand for the various types of foundry iron and (2) to estimate the relative works costs of each grade.

Pig iron requirements of Indian foundries.

16. During the three year period from 1948 to 1950, there has been available to the Indian foundry industry approximately an average quantity of 400,000 tons of iron annually. It is difficult to determine what proportion of this tonnage was of standard foundry specifications but it is believed that at least two-thirds was of foundry quality, the balance being 'off-grade' so far as the foundries are concerned. We have been informed that the proportion of so-called 'off-grade' iron is on the increase and the foundry and engineering industries have made representations to Government and to the Board concerning their increased costs as a result of being forced to use off-grade' iron in order to maintain production and have asked for relief in the form of reduced prices for such 'off-grade' iron.

A recent survey of the foundry industry by the Steel and Cement Directorate, Ministry of Commerce and Industry, has shown that the 1800 odd Indian foundries have a minimum pig iron consuming capacity of 400,000/420,000 tons per year. This estimate is based on the assumption that the small foundries melt iron on only one day per week and use only 50 per cent. pig iron in the charge, the balance being scrap. The conclusions of this survey would appear to be corroborated by the figures of pig iron sales of the producers during the past three years and also by the acceptance by the foundries of large quantities of off-grade iron even though the use of such iron results in higher production costs.

The same survey, however, indicates that the present screened demand of the foundries is considerably higher and may be considered as of the order of 600,000 tons annually. It is estimated that of the total demand, approximately 200,000 tons of off-grade quality might be acceptable but the balance should be of foundry quality.

Availability of iron to foundries in future.

17. To meet the actual minimum demand of 400,000/420,000 tons and the screened requirement of 600,000 tons, the availability of iron for sale to the foundries in the future cannot be considered as more than 260,000 tons consisting of 200,000 tons of foundry grades from Kulti and 60,000 tons, mostly of off-grade quality, from the Tata Works. It is apparent, therefore, that at present only about two-thirds of the minimum and less than half of the actual screened demand of the foundries will be met. This deficit arises from the utilization for increased steel production at SCOB of surplus pig iron from Hirapur, which formerly was sold to the foundries.

The foundry situation may be even further aggravated within the next few years by the use of a portion of the Kulti capacity for the production of basic iron for conversion into steel at SCOB. During the recent steel prices inquiry, the Board estimated the ingot capacity of SCOB as at least 525,000 tons. In determining the retention prices of steel, however, the Board allowed for the production of only 440,000 tons of ingots at SCOB as this was the maximum tonnage of steel which could be produced from Hirapur iron alone and as, in view of the acute shortage of foundry iron, it was considered that Kulti iron should be reserved for sale to the foundries. Kulti iron has, however, been used on occasions to make steel at SCOB and a special railway was constructed between the two works to make transfer of hot metal from Kulti to SCOB possible. Should SCOB want to attain capacity production, nearly 100,000 tons of Kulti iron might be used at SCOB in which event the supply of foundry iron would be reduced to about 40 per cent. of the actual minimum requirement.

In this connection, Government have been assured by SCOB that upon the completion of its current expansion programme, SCOB will produce 400,000 tons of saleable steel. The production of this quantity of saleable steel will require the consumption of approximately 500,000 tons of pig iron. The normal annual production of the Hirapur furnaces, after allowance for periodic shut-downs for relining, has been estimated at 420,000 tons. It is evident that SCOB cannot keep its commitments to Government regarding production without drawing upon Kulti pig iron production to the extent of approximately an average of 80,000 tons annually. The expansion programme of SCOB is scheduled for completion by the end of 1953 by which time there will not be more than 120,000 tons of foundry iron available from Kulti.

A further threat to the production of foundry iron comes from the fact that additional ferro-alloys will be required at SCOB because of the increased production of steel. It is likely that such ferro-alloys will have to be produced at Kulti as the Tata Company is no longer in a position to sell large quantities of ferro-alloys. The production of SCOB's requirements of ferro-alloys at Kulti would reduce the production of foundry iron by perhaps a further 15,000 tons.

The complete picture, however, with reference to the seriousness of the position of pig iron supply to the general foundry industry (*i.e.*, all those foundries which, unlike IISCO, have to purchase their requirements of pig iron in the market), is not adequately indicated above. As stated earlier, IISCO itself owns several large foundries, the annual pig iron consumption of which is in the neighbourhood of 100,000 tons. Obviously, IISCO will take care of the requirements of its own foundries before offering any iron for sale to the general foundry trade. Accordingly, the quantity of iron which may be expected to be available for the general foundry trade after providing for the requirements of IISCO's foundries is reduced to 160,000 tons. This is about 50 per cent. of the bare minimum requirements and about 33 per cent. of the screened requirements of the general foundry industry of India. It is apparent that the general foundry and engineering industry of India is threatened with a severe curtailment of its already extremely low rate of operations which is certain to have a drastic result on Indian industry in general.

Summary of the position regarding pig iron supplies.

18. The situation with respect to the supply of iron to the foundries may be summarised as follows:-

(1) *The Indian Iron and Steel Company*.- In 1951-52, IISCO will have approximately 100,000 tons of foundry iron for sale which may be supplemented by between 20,000 and 35,000 tons of off-grade iron from Hirapur. By 1953-54, however, the hot metal and ferro-alloy requirements of SCOB plus the foundry iron requirements of IISCO's own foundries will be such as to consume the entire output of IISCO's blast furnaces. Accordingly, it is apparent that within a period of two to three years, IISCO will be unable to provide any iron at all to the general foundry industry. In the meantime, it can be expected that the availability of foundry iron from IISCO will consistently decrease as SCOB succeeds in increasing its steel production.

(2) *The Tata Iron & Steel Company*.- At present, the Tata Company has a surplus of the order of 60,000 tons of pig iron for sale. The Company's modernisation and expansion programme for steel, however, which can be expected to be well under way by 1953-54, will make necessary the use of all of its present surplus pig iron plus an additional amount of at least 100,000 to 150,000 tons which will undoubtedly require enlarging some of the Company's smaller

blast furnaces. Accordingly, it is extremely unlikely that there will be any surplus iron for sale from the Tata Works after two to three years.

(3) *The Mysore Iron & Steel Works.*- This company has no surplus iron available for sale to the general trade and its expansion programme provides for the consumption of any increased production of pig iron within its own works.

It is, therefore, evident that within a period of two to three years the entire general foundry industry will be faced with complete cessation of operations or else be compelled to import foreign pig iron at three to four times the price of indigenous metal. We do not believe that the Indian foundry industry can be economically run if it is forced to operate on high-cost foreign metal.

The above analysis leads us to the conclusion that the general foundry industry will be threatened with complete collapse within a period of two to three years unless prompt, immediate, remedial measures are taken.

Importance of ensuring adequate supplies of pig iron to the foundry industry.

19. The importance of ensuring adequate supplies of iron to the foundry industry may not perhaps be generally realised. The survey of the foundry industry referred to earlier indicates that the distribution of the minimum annual iron requirements of the foundries is as follows:-

(1) Light engineering industries.	35,000 tons	(250,000 to 300,000 tons for agricultural implements alone).
(2) IISCO's own foundry for C.I. spun pipes & specials and sleepers for railways.	100,000 tons	
(3) Government and Railway Workshops.	50,000 tons	

(4) Heavy engineering industries like textiles, cement, sugar mill machinery, etc. both for normal production and maintenance.	50,000 tons
(5) Miscellaneous like C.I. pans, municipal & sanitation equipment like manhole covers, bazaar weights, etc.	50,000 tons
Total	600,000 tons

By 1953/54, there will be no iron available to meet any of the above requirements with the exception of the IISCO's own foundries (item No. 2). Even in 1951-52, it is probable that not over 160,000 tons of iron will be available to meet the remaining minimum requirement of 300,000/320,000 tons.

The catastrophic effect of such a situation not only on industry in general which requires castings as components of machinery and equipment and as spare parts for maintenance but also on agriculture as a result of a shortage of agricultural implements and on the railways as a result of inability to provide replacement parts, is too evident to require emphasis. During the past several years, Government have taken vigorous steps either to initiate or stimulate the production of railway locomotives, agricultural equipment, machine tools, motor cars and ships. Castings form a large part of all of the above articles and there can be no hope for the development of or self-sufficiency in the manufacture of such equipment unless an adequate supply of iron is available for the production of the required castings. It is certain that if the steel companies are to be encouraged to operate at an increased rate, such increased steel production can result only from the use of iron now being sold to the foundry trade. Accordingly, it is vital that an alternate source of foundry iron should be provided if the foundry industry is to avoid complete collapse and the various new industrial undertakings are to succeed. The only remedy is to provide additional pig iron producing facilities above those now existing in the country.

We are informed by our Technical Adviser that even under the most favourable conditions it is unlikely that a blast furnace and the necessary coke ovens could be built in a period of less than 30 months. It is evident, therefore, that even though immediate steps were taken for the building of additional pig iron producing capacity, the facilities could not come into operation before the end of 1953 by which time we expect the general foundry trade to be almost completely without iron. We need hardly stress that this would be a most serious situation which may have far-reaching effects on the country's overall economy. We accordingly urge Government to give this problem their most serious consideration and to take such action as will ensure availability of adequate supplies of iron to the general foundry trade, having due regard, at the same time, to the necessity of maximising the steel production of the country.

Types and qualities of pig iron.

20. In view of the critical shortage of iron, it is essential that measures should be taken to make available to the foundries those qualities of iron which they require most and can use best.

As has been indicated previously, the future supply of iron to the foundries will consist of two types of metal:-

(1) Standard foundry grades produced at Kulti.

(2) Excess steel-making iron and off-grade steel-making iron produced at Hirapur and at the Tata Works.

The essential difference between the foundry and steel-making grades of iron particularly in India is in their content of silicon and manganese. Most of India's steel is produced by either the straight duplex process or some modification thereof. The duplex process involves preliminary refining of the iron in an acid Bessemer converter.

It is essential in the acid Bessemer operation that the manganese content of the iron should be low, being not more than 0.60 per cent. to 0.65 per cent. A minimum amount of silicon is required as the oxidation of the silicon is the chief source of the heat required in the process. For good operation it is necessary that the silicon content of the iron should be approximately 2-2½ times the manganese. Accordingly, even with the maximum manganese content the silicon analysis of metal for the duplex process should preferably not exceed 1.50 per cent. to 1.60 per cent.

For steel-making by the open hearth process, iron of considerably lower silicon is preferred. It is highly desirable that the silicon content of the iron should not exceed 1.25 per cent., while lower silicon will result in more economical operation. The manganese content of this type of iron should preferably be of the order of 1.50 per cent., although iron of much lower manganese content can be used by adding manganese ore to the open hearth charge.

General purposes foundry irons, on the other hand, should have an appreciably higher content of silicon than the steel-making irons and a manganese content somewhat higher than permitted in iron for use in the Bessemer converter. The necessity for the high silicon content arises from the fact that the properties of castings are governed mainly by their silicon content. This is especially true with respect to machineability. The hardness of the casting is chiefly a function of the silicon and with castings much below 1.50 per cent. in silicon machining becomes a difficult and costly operation.

With reference to manganese, the function of which is to offset the deleterious effect of sulphur, a content of the order of 0.6 per cent. to 0.8 per cent. is adequate for most castings.

Accordingly, it is desirable that those grades of foundry iron should be provided to the foundries which after mixing with the other components of the cupola charge and after melting will produce a metal analysing approximately 1.50 per cent. to 2.00 per cent. silicon or, say, on the average 1.75 per cent., and 0.6 per cent. to 0.8 per cent. manganese averaging, say, 0.7 per cent., for pouring into the moulds in which the castings are formed.

Nature of melting operation at the foundry.

21. The nature of the melting operation is such, however, that there is a loss of silicon and manganese in the slag of approximately 15 per cent. for which compensation must be made in the charge. The cupola charge, therefore, should average about 2.00 per cent. silicon and 0.8 per cent. manganese and this would be the most desirable analysis of foundry iron for general purpose use, if the cupola charge were composed of only pig iron.

The charge, however, contains other ferrous materials both for reasons of economy and also for the purpose of influencing the properties of the castings. In foundry operations, cast iron scrap which may amount to as much as 20-30 per cent. of the tonnage of castings is produced. Such scrap is of course recharged to the melting unit. As its analysis, however, is the same as that desired in the castings, the melting loss of silicon and manganese must be compensated for by an increase in the content of these elements in the pig iron.

It is also highly desirable to use a proportion of steel scrap which may vary from 10 per cent. to 30 per cent. as a component of the charge. The desirability of the use of steel scrap arises from two sources, namely,

(i) *Metallurgical:* The carbon content of pig iron is too high to produce a desirable grade of casting. The carbon content of the casting is controlled through charging steel scrap which has a low content of carbon and, accordingly, lowers the carbon in the final casting.

(ii) *Economic:* In view of the great shortage of pig iron, steel scrap can be used to supplement iron in the production of castings.

The silicon analysis of ordinary grades of steel is much lower than that of pig iron, being perhaps of the order of 0.30 per cent. to 0.60 per cent. Consequently, the silicon content of the pig iron must be high enough both to offset the deficiency of silicon in the steel scrap and to compensate for the slagging loss in the cupola.

The last major ferrous component of the charge is purchased scrap iron. This may be assumed to be of average casting analysis. As in the case of re-cycled plant scrap, the cupola melting loss must be compensated for by additional silicon and manganese in the pig iron.

The fresh pig iron which may form not more than 50 to 60 per cent. of the total charge should accordingly contain at least 2.25 per cent. to 2.75 per cent. silicon and 0.80 per cent. to 0.90 per cent. manganese in order to compensate for the deficiency in these elements in the balance of the charge and for cupola melting losses.

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Types of pig iron supplies available for foundries.

22. The future pig iron supply, however, will not be composed of entirely foundry grades but will also include a considerable proportion of excess and off-grade steel-making iron. The analysis of these irons in general in the past has been generally below 1.50 per cent. silicon and unless the steel makers are encouraged to pig more of desirable irons for the foundries, the excess of steel-making iron can be expected to continue to be of undesirable analysis for foundry uses.

It is expected that of the total supply of iron available to the general foundry industry, at least 40 per cent. iron will be supplied as off-grade and excess iron from the steel producing plant. The foundry grades of iron accordingly should be of sufficiently high silicon to compensate for the deficiency in the steel-making irons. Accordingly, it is necessary that the foundry iron production at Kulti should consist chiefly of the high silicon grades, *viz.*, 2.25 per cent. to 2.75 per cent. and 2.75 per cent. to 3.25 per cent.

Current ex-works retention prices of various grades of iron.

23. (a) The following table shows the specifications and current ex-works retention prices of the various grades of iron sold in India:

(Table on page 28)

In addition to the above prices, there are certain quality differentials which apply to irons outside the above specifications. These are as follows:-

(i) *Silicon Extras:* Rs. 2/- per ton extra for every 0.5 per cent. increase in silicon over grade 1.

(ii) *Duplex Iron:* Rs. 2/- per ton less than the base price applicable for respective foundry grades. This penalty is because of the low manganese content as duplex iron contains less than 0.5 per cent. manganese.

(iii) *High Manganese:* Rs. 2/- per ton extra for every increase of 1 per cent. or fraction thereof in the manganese content over 1.5 per cent.

(iv) *High Sulphur:* For basic irons only there is a penalty of Rs. 10/- per ton for high sulphur.

(b) The general principles of the above pricing system are as follows:-

(1) *Silicon:* A differential of Rs. 2/- per ton is charged for each increase of 0.50 per cent.

(2) *Manganese.* Despite the existence of a high (1.0 per cent. to 1.50 per cent.) and a low (0.50 per cent. to 1.00 per cent.) manganese grade of foundry iron, there is no price differential between the two. There is, however, a penalty of Rs. 2/- levied against duplex iron (under 0.50 per cent. manganese) because of its low manganese content. Likewise, there is an extra of Rs. 2/- per ton for manganese above 1.50 per cent.

(3) *Sulphur:* There is no penalty for off specification sulphur in the foundry grades. There is a penalty of Rs. 10/- per ton for off-grade basic specification.

STANDARD GRADES
(High Manganese)

	No.	Silicon per cent.	Manganese per cent.	Phosphorus per cent.	Sulphur per cent.	Ex-works retention price
						Rs. per ton
Standard foundry	1	2.75-3.25	1.00-1.50	Under 0.40	Under 0.035	92
	2	2.25-2.75	"	"	Under 0.050	90
	3	1.75-2.25	"	"	"	88
	4	1.50-1.75	"	"	"	86
Special	4X	1.25-1.50	"	Under 0.35	"	86
Special Basic		1.00-1.25	"	"	"	84
Standard Basic		1.00 & under	"	"	"	84

LOW MANGANESE GRADES

	No.	Silicon per cent.	Manganese per cent.	Phosphorus per cent.	Sulphur per cent.	Ex-works retention price
Low Manganese foundry	1	2.75-3.25	0.50-1.00	Under 0.40	Under 0.035	92
	2	2.25-2.75	"	"	Under 0.050	90
	3	1.75-2.25	"	"	"	88
	4	1.50-1.75	"	"	"	86
Special	4X	1.25-1.50	"	Under 0.35	"	86
Low Manganese Basic Special		1.00-1.25	"	"	"	84
Low Manganese Basic		1.00 & under	"	"	"	84

Determination of proper differentials for various grades of iron.

24. The average works cost per ton of all grades of foundry iron, *viz.* Rs. 83.29, and the average overheads per ton, *viz.*, Rs. 25.90, which have been determined by the Board may be considered to represent the costs and overheads of foundry iron corresponding to grade III (1.75 per cent. to 2.25 per cent.) silicon and of a mixture of irons of high and low manganese. The Board considers that it is of great importance to assess carefully the differential charges to be added to or substracted from the price of grade III (the base grade) in order to compensate the producers properly for, and to stimulate the production of, the grades of iron of greatest use to the foundries.

The production of a blast furnace is a function of two factors:-

(1) The quantity of coke which can be burned by the furnace per unit time, and

(2) the quantity of coke required for the production of a ton of product.

As regards (1), *viz.*, the amount of coke per unit time which the furnace can burn, it may be stated that for a particular furnace under a given set of raw material conditions, this tends to be relatively consistent for the production of standard grades of iron. As for (2), *viz.*, the consumption of coke, this varies appreciably with the grade of iron being produced.

Taking grade No. III (1.75 per cent. to 2.25 per cent. silicon) as the standard, the consumption of coke per ton of product will increase by about 5 per cent. for every increase of silicon by 0.50 per cent. Conversely, there will be a corresponding decrease in coke consumption for similar decreases of silicon in the product. As the total consumption of coke per unit time is relatively constant, the production will decrease by about 5 per cent. for every increase of 0.50 per cent. and increase by 5 per cent. for every decrease of 0.50 per cent. in the silicon analysis.

Both the elements of price, *viz.*, works costs and overheads, are affected by the analysis of the metal. The variation in the coke consumption affects the material cost element in the works costs. A decreased or increased production rate alters both the conversion cost element and the works costs and overheads. As regards works costs, the cost of coke per ton of iron of grade III (1.75 per cent. to 2.25 per cent. silicon) in the future estimates has been taken at Rs. 38.74. The differential in coke costs for each change of 0.50 per cent. silicon accordingly works out to be approximately Rs. 1.94 per ton. The conversion cost, exclusive of pig machine expense, of grade III iron has been estimated at Rs. 21.29. The conversion cost can be considered to vary almost in inverse proportion to the production rate. The differential in conversion cost, accordingly, may be taken at approximately Rs. 1.06 per ton for every change of 0.50 per cent. in silicon content. The total differential in works costs for each change of 0.50 per cent. in silicon works out to Rs. 3.00 (*i.e.*, coke consumption Rs. 1.94 and conversion cost Rs. 1.06).

We have calculated the overheads per ton of grade III as Rs. 25.90. The differential in overheads due to changed production rates amounts to Rs. 1.30 per ton for every change of 0.50 per cent. silicon. The total differential accordingly works out to be Rs. 4.30 per ton which we have rounded off to Rs. 4.0 and which we consider the proper differential in price for each change from the base grade of 0.50 per cent. silicon.

We have commented earlier that there is a differential for manganese below 0.50 per cent. and for manganese above 1.50 per cent. There is no differential, however, between the so-called low (0.50 per cent. to 1.00 per cent.) and the standard (1.00 per cent. to 1.50 per cent.) manganese grades. The average works cost which we have established for grade III iron has been calculated on the average manganese content of the grades of iron produced in 1949-50, and represents, accordingly, neither the cost of the normal low or standard grade. In view of the greatly increased cost of manganese ore, we are of the opinion that a differential of Rs. 2/- should be established between the low and standard grades similar to that now existing between the foundry and the duplex grades. We, therefore, have established such a differential by (a) adding, for the standard grade (*i.e.*, 1.00 per cent. to 1.50 per cent. manganese), Re. 1/- to the price of the average foundry grade as calculated by us and (b) deducting Re. 1/- for the low manganese grades. The present differentials of minus Rs. 2/- for duplex and plus Rs. 2/- for high manganese, have been retained.

At the present time, there is no sulphur differential for the foundry grades but there is a penalty of Rs. 10/- for high sulphur in the basic grades. High sulphur iron, while perhaps it is not quite harmful in foundry irons as in steel-making irons, nevertheless can be used in only limited quantities by the foundries. If, however, the sulphur content is so high as to require treatment for its removal, it will increase foundry costs. There is also little reason for the production of more than minor percentage of high sulphur iron in foundry practice if normal care is exercised in the blast furnace operations. We have, accordingly, included in our recommendations a penalty for high sulphur in all grades. The penalty, however, should be proportional to the sulphur content and, therefore, instead of the present penalty of Rs. 10/- for all high sulphur in the basic grades, we have adopted the following sulphur penalty schedule for all grades:-

Off-grade sulphur schedule:-

Sulphur 0.065 per cent. and under	Rs. 2
Sulphur 0.066 per cent. to 0.080 per cent.	Rs. 5
Sulphur over 0.080 per cent.	Rs.10

Formula for price schedule of pig iron.

25. On the basis of the analysis given above, we recommend that the following formula should be adopted for the pig iron price schedule:-

Base grade - standard foundry iron grade No. 3.

Analysis	Silicon	1.75 per cent. to 2.25 per cent.
	Sulphur	under 0.050 per cent.
	Manganese	1.00 per cent to 1.50 per cent.
	Phosphorus	under 0.40 per cent.

Silicon differential:- Rs. 4/- per ton for each increase or decrease of 0.50 per cent. from base grade.

Manganese differential:- Rs. 2/- per ton for each increase or decrease of 0.50 per cent. from base grade.

Sulphur penalty:- Rs. 2/- per ton for off-grade sulphur to a maximum of 0.065 per cent. Rs. 5/- per ton for off-grade sulphur between 0.066 per cent. and 0.080 per cent., and Rs. 10/- per ton for all off-grade above 0.080 per cent.

These schedules apply to all grades of iron with the exception that the differentials for silicon are not to apply to iron below 1.00 per cent. silicon.

Schedule of ex-works retention prices recommended by the Board.

26. Based on the formula for differentials as laid down in the preceding paragraph, we recommend that the retention prices, ex-works, for different grades of pig iron, should be as tabulated below. For purposes of comparison, the current ex-works price and the amount of increase recommended are also given side by side.

STANDARD GRADES
(High Manganese)

Grade		Analysis				Ex-works price recommended for the future Rs. per ton	Current ex-works price Rs. per ton	Increase Rs. per ton
		Silicon per cent.	Manganese per cent.	Phosphorus per cent.	Sulphur per cent.			
Standard foundry	1	2.75-3.25	1.00-1.50	Under 0.40	Under 0.035	118	92	26
	2	2.25-2.75	"	"	Under 0.050	114	90	24
	3	1.75-2.25	"	"	"	110	88	22
	4	1.50-1.75	"	"	"	108	86	22
Special	4X	1.25-1.50	"	Under 0.35	"	106	86	20
Special basic		1.00-1.25	"	"	"	104	84	20
Standard basic		1.00 & under	"	"	"	102	84	18
LOW MANGANESE GRADES								
Low manganese foundry	1	2.75-3.25	0.50-1.00	Under 0.40	Under 0.035	116	92	24
	2	2.25-2.75	"	"	Under 0.050	112	90	22
	3	1.75-2.25	"	"	"	108	88	20
	4	1.50-1.75	"	"	"	106	86	20
Special	4X	1.25-1.50	"	Under 0.35	"	104	86	18
Low manganese basic special		1.00-1.25	"	"	"	102	84	18
Low manganese basic		1.00 & under	"	"	"	100	84	16

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We recommend, in addition, the following schedule of quality differentials for all grades:

Silicon:	Rs. 4/- per ton extra for each increase of 0.50 per cent. above No. 1 foundry grade.
Manganese:	Rs. 2/- penalty for manganese below 0.50 per cent. and Rs. 2/- premium for each 0.50 per cent. increase above 1.50 per cent.
Sulphur:	Penalties for off-grade:- Rs. 2/- per ton for sulphur up to 0.065 per cent. and under, Rs. 5/- per ton for sulphur between 0.066 per cent. and 0.080 per cent., and Rs. 10/- per ton for sulphur over 0.080 per cent.

Special advantages of the proposed formula.

27. The adoption of the formula as well as the price schedule recommended by us will be of material advantage to both producers and consumers of pig iron. As regards the producers, the new price schedule will compensate them properly for the extra costs of producing the types of foundry iron which are required by the Indian foundries but which are not being produced at present in sufficient proportions owing to the inadequacy of compensation provided for in the current price schedule. The proposed price schedule will also provide an inducement to the integrated steel works to utilize more off-grade iron in their shops and encourage thereby the pigging of more suitable grades of excess iron for sale to the foundries since the new formula establishes price differentials adequate to offset any additional steel production costs as a result of consuming off-grade iron in steel making.

As regards the consumers, the most immediate benefit of the proposed price revision will be to increase the proportion of suitable grades and decrease the proportion of off-grade and unsuitable iron. This should be of material assistance from the stand-point of foundry costs as the slightly higher price differentials for suitable grades of iron provided for in the proposed price schedule should be more than offset by a reduction in foundry costs as the result of an increase in the proportionate supply of proper grade of iron. In the absence of iron of suitable analysis, the production of good castings requires the foundries to compensate for deficiencies in iron quality by the use of expensive ferro-alloys. The cost of replacing a deficit of 1.00 per cent. silicon in pig iron by the use of ferro-silicon is approximately Rs. 14 per ton. Similarly, the cost of replacing a deficit of 1.00 per cent. in the manganese content of iron by the use of ferro-manganese is approximately Rs. 7 per ton. Even with the increase in grade differentials, the cost of 1.00 per cent. silicon in pig iron will be only Rs. 8 and the cost of 1.00 per cent. manganese only Rs. 4, both of which are substantially lower than the cost of supplying the same quantity of silicon or manganese by the use of ferro-alloys.

The proposed schedule of grade differentials, accordingly, while providing proper compensation to the iron producers for their costs in producing desired grades of iron, at the same time will help the foundries to avoid cost increases resulting from the extensive use of high cost ferro-alloys.

Freight disadvantage.

28. Representations have been made to us that the present system of quoting prices F.O.R. ports and allowing a freight disadvantage on that basis is unfair and that the manufacturers are thereby incurring a loss. The terms of reference to the Board, however, confine this inquiry to determine the fair ex-works retention prices. Accordingly, we have not examined this question, but we suggest, as in the previous Report, that the question of freight disadvantage should be reviewed by Government at an early date.

Summary of conclusions and recommendations.

29. Our main conclusions and recommendations may be summarised as under:-

(i) Of the three manufacturers of pig iron in the country, *viz.*, the Tata Iron and Steel Company, the Indian Iron and Steel Company and the Mysore Iron and Steel Works, neither the Tata Iron and Steel Company nor the Mysore Iron and Steel Works regularly produces foundry grades of iron for sale to merchant foundries. In future, practically all the pig iron manufactured at the Hirapur Works of the Indian Iron and Steel Company (IISCO) will be used for steel-making by SCOB. Accordingly, the Kulti plant of IISCO should be regarded as the sole regular producer of irons of foundry grade, and the price for iron of such grades must be based solely on the costs of production at the Kulti Works. (Paragraphs 3 to 9)

(ii) The works cost of pig iron per ton at Kulti increased from Rs. 72.35 in 1948 to Rs. 84.19 in 1949-50. Of the total increase of Rs. 11.84 in works cost per ton, the increase under material costs accounts for Rs. 8.26 and increase in conversion costs for Rs. 3.58. (Paragraphs 10 and 11)

(iii) (a) The Board is of the opinion that the increases in works costs were substantially beyond the control of the management and that the Kulti plant in its present condition will continue to be a high-cost one. (Paragraph 11)

(b) The Railway Board should review the question of restoring the original concessional freight rate to the Kulti Works with a view to assisting the Company to reduce the cost of pig iron. (Paragraph 11)

(iv) The Board's estimate of future works costs of Grade III foundry iron at Kulti comes to Rs. 83.29 per ton, representing a decrease of Rs. 1.76 per ton, which is equivalent to a decrease of slightly over 2 per cent. from the actual cost for 1949-50. In arriving at this estimate, the total production of all grades of foundry and high silicon irons has been taken at 200,000 tons per year. (Paragraphs 12 and 13)

(v) In determining the overhead charges, the Board has more or less followed the same principles as had been adopted in the previous Report, except in respect of depreciation.

Having regard to the necessity of replacing the present Kulti plant after five or six years and in consultation with our Technical Adviser, we have made a total provision of Rs. 24 lakhs for depreciation (that is, Rs. 11 lakhs as normal depreciation *plus* Rs. 13 lakhs gross as special depreciation). The overhead charges work out to Rs. 25.90 per ton as against Rs. 19 per ton which had been allowed in the previous inquiry. (Paragraph 14)

(vi) It is estimated that the minimum pig iron consuming capacity of Indian foundries is 400,000/420,000 tons per year, while the present screened demand of the foundries is estimated at 600,000 tons per year. (Paragraph 16)

(vii) At present only about two-thirds of the minimum and less than half of the annual screened demand of the foundries can be met from available indigenous supplies of pig iron. As the Steel Corporation of Bengal and the Tata Iron and Steel Company proceed to implement their expansion programmes for steel within the next two or three years, the position of supply of pig iron to the foundries will become acute which will have a catastrophic effect not only on industry in general, which requires castings as components of machinery and equipment and as spare parts for maintenance but also on agriculture as a result of the shortage of agricultural implements and on the railways as a result of inability to provide replacement parts. It may also render extremely difficult the implementation of the programme of production of railway locomotives, machine tools, motor cars and ships. The Board, therefore, urges Government to give this problem their most serious consideration and take such action as to ensure availability of adequate supply of iron to the general foundry trade, having due regard, at the same time, to the need of maximising the steel production of the country. (Paragraphs 17 to 19)

(viii) In view of the critical shortage of iron, it is essential that measures should be taken to make available to the foundries those qualities of iron which they require most and can use best. For this purpose, it is necessary that the foundry iron production at Kulti should consist chiefly of the high silicon grades, *viz.*, 2.25 per cent. to 2.75 per cent. and 2.75 per cent. to 3.25 per cent. (Paragraphs 20 to 22)

(ix) The current price schedule of pig iron does not provide adequate compensation for the extra cost of producing the types of foundry iron which are required by the Indian foundries with the result that such irons are not being produced at present in sufficient proportions. We have, therefore, recommended a new formula for differentials which will give adequate compensation for the extra costs of producing the most desirable types of foundry iron in larger proportion than is the case at present. (Paragraphs 23 to 25)

(x) Based on the new formula for differentials, we have recommended a schedule of ex-works retention prices for pig iron. (Paragraph 26)

(xi) The proposed schedule of grade differentials, while providing proper compensation to the iron producers for their extra costs in producing desired grades of iron, will at the same time help the foundries to avoid cost increases resulting from the extensive use of high-cost ferro-alloys. It will also give incentive to the integrated steel works to provide iron of more suitable analysis to the foundries. (Paragraph 27)

(xii) It is recommended that the question of freight disadvantage should be examined by Government at an early date. (Paragraph 28)

Acknowledgments.

30. We have much pleasure in acknowledging the ready co-operation we received from the Indian Iron and Steel Company. We have also to thank Shri C.R. Natesan, Deputy Secretary, Ministry of Commerce and Industry, and Shri M.K. Powvala, Iron and Steel

Controller, Government of India, for giving evidence during the inquiry. Mr. Peter V. Martin of Koppers Co. Inc., of Pittsburgh, Pennsylvannia, U.S.A., who was engaged by the Government of India specially to work as Technical Adviser to the Board, was closely associated with us at every stage of the inquiry. He took great pains to examine the technical factors affecting the production of pig iron in India. He also investigated in great detail the problem of supply of suitable qualities of foundry iron in the country and furnished the Board with a number of informative and very instructive notes of the subject. We have incorporated all of his important suggestions in this Report. He also advised the Cost Accounts Officer in the preparation of cost estimates. We have much pleasure in recording our high appreciation of his most valuable work as Technical Adviser. We have also to thank Shri N. Krishnan, the Cost Accounts Officer attached to the Board, for the efficiency with which he has carried out the cost investigation.

H.L. DEY,

President.

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B.V. NARAYANASWAMY,

Member.

M.A. MULKY,

Secretary.

Bombay,
28th June, 1951.

APPENDI

(*Vide* paragraph 2)

List of persons who were examined by the Board.

13th, 14th & 16th April, 1951.

1. Shri I.S. Puri Representing the Indian Iron and
2. Mr
3. Sh
4. Sh
5. Sh

17th

1. Shri Biren Mookerjee
2. Shri I.S. Puri

18th April, 1951.

1. Shri C.R. Natesan,
   Deputy Secretary to the Govt. of India,
   Ministry of Commerce and Industry,
   New Delhi.

2. Shri M.K. Powvala,
   Iron and Steel Controller,
   Government of India,
   Calcutta.